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ABSTRACT

Electronic Classroom is an Australian-developed software product that provides a shared screen facility between two to six Apple Macintosh computers using standard telephone lines and modems. It provides an icon-based "paint" interface with point and click switching of control between sites. Used in conjunction with an additional voice line, the software provides an easy to use, a robust and relatively low cost audiographic teleconferencing system. Electronic Classroom is already in use in distance education programs in every Australian state and mainland territory. Currently over 500 sites are being used to teach dozens of different subjects from primary school to university. Evaluation studies have found that students using Electronic Classroom often felt involved in the learning process more than might be the case with "regular" classroom methods. They were able to clearly differentiate between different teachers and their respective teaching styles, and preferred teachers who facilitated discussion rather than those who delivered a one-way address. (Author)

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Electronic Classroom®:Features, Users and Evaluation Studies

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

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Abstract: Electronic Classroom is an Australian developed software product(1) that provides a shared screen facility between two to six Apple Macintosh™ computers using standard telephone lines and modems. It provides an easy to learn icon based "paint" interface with point and click switching of control between sites. Used in conjunction with an additional voice line (loud speaking telephone) the software provides and easy to use, robust and relatively low cost audiographic teleconferencing system.

Electronic Classroom is already in use in distance education programs in every Australian state and mainland territory. Currently over 500 sites are being used to teach dozens of different subjects at all levels from primary school to university.

Evaluation studies have found that students using Electronic Classroom often felt involved in the learning process more than might be the case with "regular" classroom methods. They were able to clearly differentiate between different teachers and their respective teaching styles and preferred teachers who facilitated discussion rather than those who delivered a one-way address. For many Australian students the virtual classroom is already a reality.

History of Development

In Australia in 1987 the Victorian Ministry of Education pioneered the notion of linking clusters of remote schools via phone(voice), fax and computer. InterMac(2), a program produced by another Australian developer, was successfully used to prove the viability of teaching lessons using a shared computer screen. In late 1988 Robert Crago of Revelation Computing Pty Ltd, at that time the supplier of Timbuktu® and Timbuktu Remote®(3), recognised the need for a faster and simpler program that would provide a shared screen environment analogous to the classroom whiteboard. By early 1989 a prototype of Electronic Classroom had been built. Version 1.0 was commercially released in February 1990. Two years later and after some 14 minor upgrades, version 2.0 was released in July 1993. In September 1992 Electronic Classroom won a Merit award from the Australian Society for Educational Technology. The citation read "Electronic Classroom is the most effective tool for linking several remove classrooms under the control of a central tutor. It facilitates learning at a distance and encourages collaborative contact between participants. It offers interactive opportunities that would otherwise be denied to isolated students...." Further details of the history and development of Electronic Classroom are provided in Crago (1992) and the regular newsletter, Electronic Classroom Update, issued by Revelation Computing.

Design Characteristics

Much of the appeal and success of Electronic Classroom is derived from its ease of use in terms of both establishing and maintaining contact between remote sites and in conducting interactive lessons using pre-prepared screens.

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(1) Electronic Classroom® was developed by Robert Crago of Revelation Computing Pty Ltd, P.O. Box 356, Zillmere, 4034, Queensland, Phone +61 7 2638891 Fax +61 7 2638871, AUST0141@applelink.apple.com
(2) InterMac is no longer under development.
(3) Timbuktu® and Timbuktu Remote® are designed as a screen sharing product for existing Macintosh™ applications and are best suited to local area network use.

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Electronic Classroom adopts a teacher-student-whiteboard analogy. The site that initiates the dial up links (the teacher) handles all connection procedures. Student sites only require the modem to be turned on and the application to be opened. As part of the design philosophy, which stresses simplicity of use, a set of "paint" rather than "draw" tools are provided (Figure 1). The tool palette, much like an early version of MacPaint®, contains the usual display elements of text, lines, rectangles, ellipses plus a rubber. Fills, line shading and colour options are available under the *Paint* menu. The result is a user friendly interface.

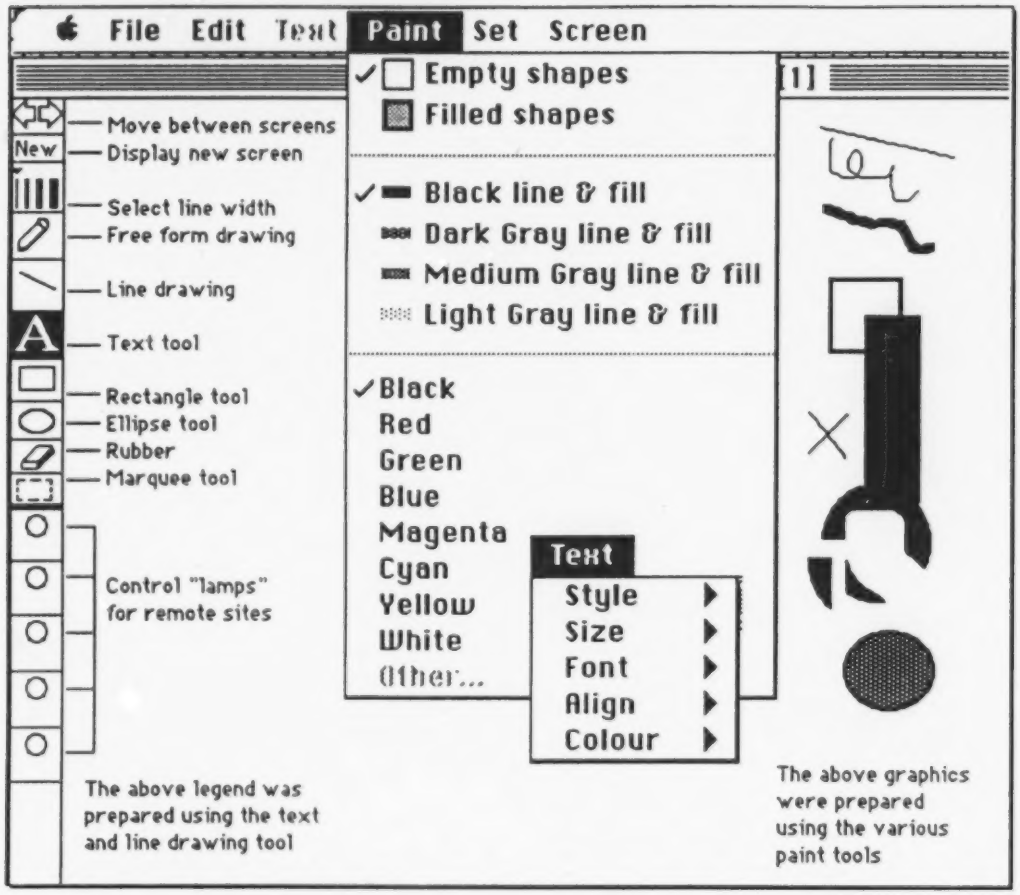

Figure 1 Top left hand corner of standard Electronic Classroom screen showing tool palette, *Paint* menu and superimposed *Text* menu.

Control of the shared screen is determined from the teacher's site with an audio signal (buzz) and flashing location lamp being used by a student site to indicate that they would like to take control of the screen - the electronic equivalent of a student raising their hand in the normal classroom setting.

Linking of three locations (the teacher plus two student sites) can be achieved by using both the modem and printer ports on one computer. To connect to an additional three sites, termed multipoint communication, it is necessary to install a Nubus card (4) with additional serial ports in one computer. The software will recognise any additional serial ports that are plugged in and will add their names to the end of the *Set* menu. The computer fitted with the multipoint card may be used as one of the lesson sites or simply set to act as a *server* with other sites dialling and connecting to it or *vice versa*. Teacher control may be initiated from any site.

At individual sites the number of students and the type of interaction expected may require either screen projection facilities, multiple screens and/or the "daisy chaining" of several keyboards. Likewise the hardware needed to handle the audio line needs to be appropriate to the size of the group at the individual sites.

(4) An example of a suitable board is the Hurder®-HDS/HQS available for Creative Solutions Inc, 4701 Randolph Rd, Suite 12, Rockville, MD 20852 USA, phone 301-984-0262

The Features of Electronic Classroom V2

A major feature of all versions of Electronic Classroom is that they will run on any Apple Macintosh™ computer from the humble Mac Plus with its 9 inch monochrome screen through to any of the high end colour machines with screen sizes up to A3 size. The program is designed handle data transfer speeds at anything from 300 to 19,200 baud. However a connection at 2,400 baud is required for reasonable data transfer speed and 9,600 baud is preferred. The former speed is almost universally achievable on the current Australian PSTN and the latter frequently achievable. For training purposes computers can be linked directly using standard printer cables. All features of the program, except the dial up procedures, are available in this direct connection mode.

For any given link up all the computers involved must have the same setting for the parameters of screen size and baud rate and preferably screen colour (monochrome or colour). As any lesson is likely to use more than one screen of information and as multiple screens are held in RAM, knowing the memory available to each computer in the link up is crucial to session planning. The *Configurations* item under the *Set* menu gives details on each computer in any link up (Figure 2). In terms of cost and performance the ideal computer for the school environment is probably a Macintosh™ LC with 8MB of RAM, 14 inch colour screen and a 9,600 baud modem.

The features of Electronic Classroom were progressively improved with each minor upgrade of version 1. With the release of version 2 significant new features were added to the program and these included: remote CD-ROM access, Quicktime™ and Photo CD support, improved screen sizing, the ability to inspect a remote machine's physical configuration, software version number and memory size, the ability to extract text for PICT files and to print one or two screens per page. Additional features are already planned for future upgrades based on user feedback and hardware developments.

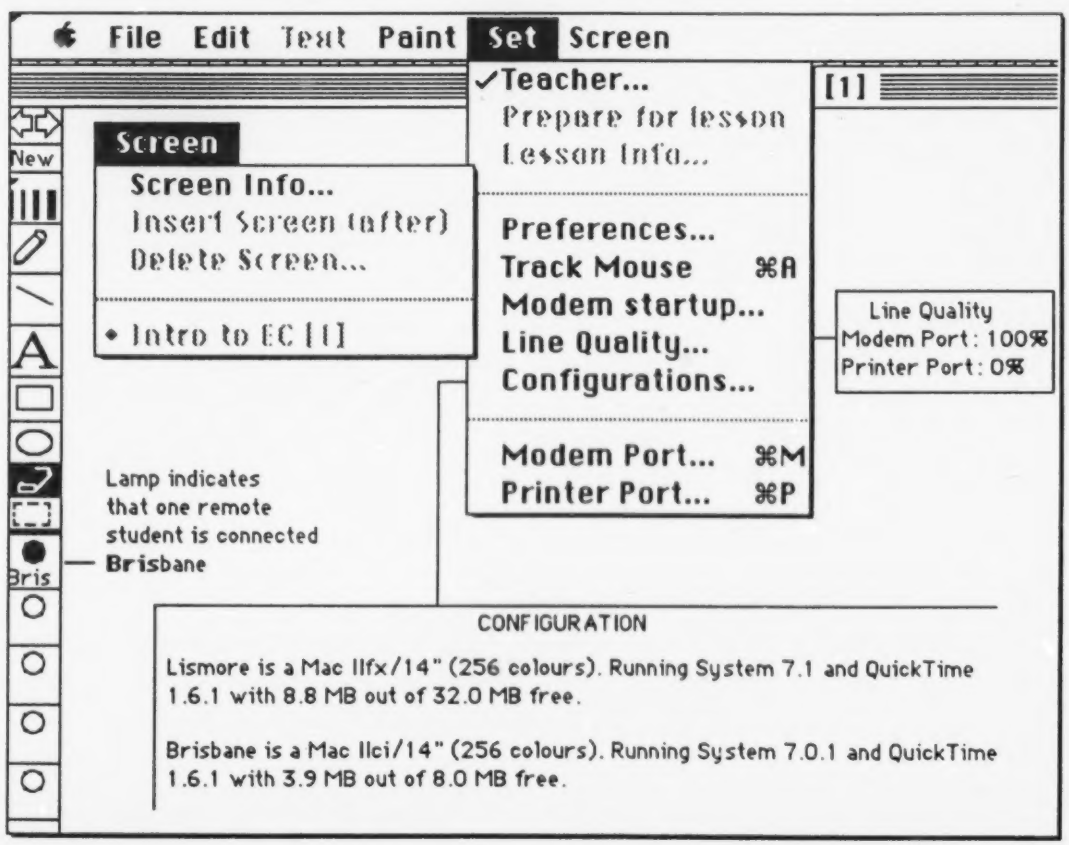

Figure 2 Shows the left hand corner of the screen after the Teacher has connected with a site named Brisbane. The *Set* menu and superimposed *Screen* menu options are shown as well as the information available under the *Configurations* and *Line Quality* items. With two computers connected by their modem ports and a printer cable the line quality is 100%.

Establishing a lesson

If you are participating in a lesson at a student site all you need to do is switch on the computer mand modem and start the application by double clicking on its icon. It will then check the state of the your serial ports for conformity with the configuration last used. For example, if the previous lesson was taught with a modem connected to the modem port, then the application will display an error if a modem cannot now be detected on the modem port. This alerts the user to possible equipment problems or perhaps the fact that the modem has simply not been turned on. With the application started and the equipment checked each site will be viewing a blank *Untitled* screen with a greyed out tool palette and at least one matching light grey status lamp (labelled M•P or P•P) visible.

A lesson can be initiated from any site by activating the *Teacher* item under the *Set* menu (Figure 1) . This requires the entry of a password, the name of the the teacher and the name of the lesson. The latter two items are transmitted to the other sites as the connections are established. The *status lamps* confirm a connection has been successfully established and indicate the first few letters of the remote site eg Bris for Brisbane in Figure 2.

Maintaining connections

As noisy or crossed telephone lines are still common in rural Australia the communications protocols built into Electronic Classroom detect such situations and continue to attempt of send information until it gets through. The *status lamps* and various dialogue boxes keep sites informed of the progress of information transfers.

Catering for different teaching and learning styles

Electronic Classroom can be used to cater for a range of teaching and learning styles. Firstly, it can be used to create all material during the actual lesson. Input can be via the keyboard, mouse or by cutting and pasting from the scrapbook or other files. New screens are created as required and both teacher and student can have input. Secondly, a number of screens can be prepared before the lesson and stored as one or more *Lesson Notes* files. Apart for the special Electronic Classroom *Lesson Note* file format, it is also possible to incorporate material from other files eg MacPaint® or PICT via the *Open* options under the *File* menu (Figure 3).

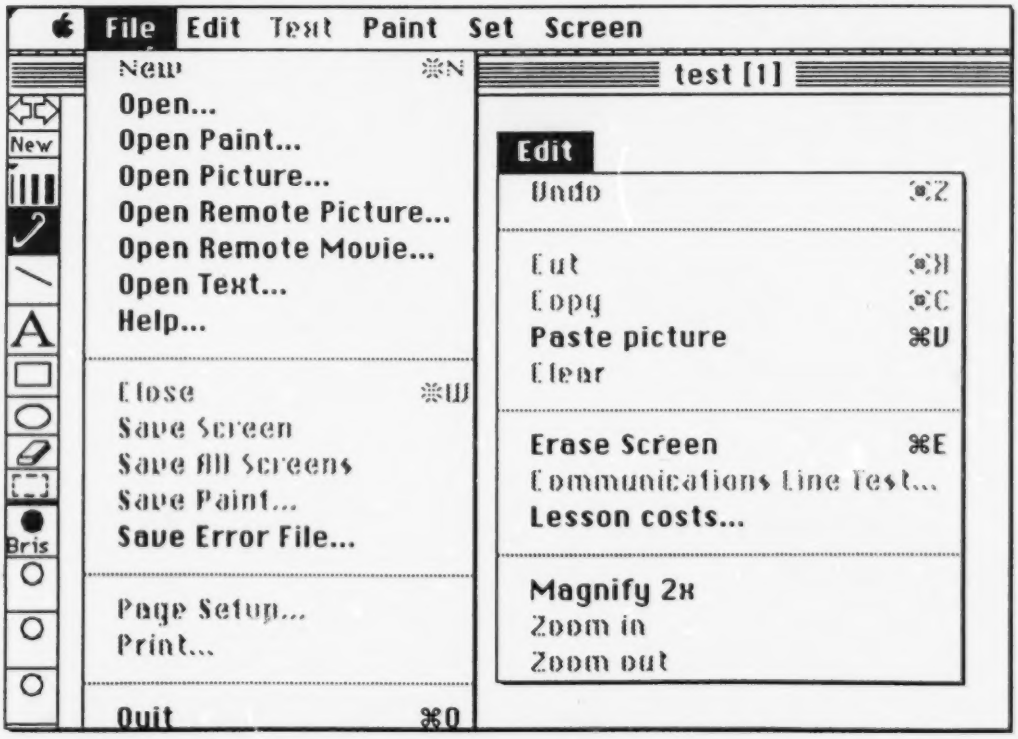

Figure 3 Top left hand corner of standard screen showing *File* menu and superimposed *Edit* menu. Note the wide range of Open ... commands including the *Open Remote...* facilities.

Who uses Electronic Classroom?

Electronic Classroom is already in use in distance education programs in all Australian States and mainland Territories. For many Australian students the 'Virtual Classroom' is already a reality. A selection of programs that use Electronic Classroom are briefly described below.

Primary schools

Some of the earliest and most successful projects are based in Victoria where the State Ministry of Education has established a support unit. Bendigo, a provincial city north of the Melbourne, is the hub of a distance education network that extends to hundreds of schools throughout the State These schools work in clusters, for example, the King Valley Cluster of four small rural primary schools (children 5 to 12 years old) use audiographic sessions as part of their Italian language teaching program. Indeed the teaching of Languages Other Than English (LOTE) has received a major boost from the introduction of audiographics technology into classrooms. Workshops attracting over 40 teachers have been held in Bendigo to develop computer-based material for the teaching of Italian, French, German, Japanese and Chinese.

In Queensland a network of 120 primary schools are involved in a LOTE program where secondary language teachers take lessons with clusters of up to five primary schools simultaneously. In this example the technology brings specialist teaching into the primary classroom setting.

Secondary schools

In Queensland a major 'Telelearning' project has involved the linking 23 secondary schools to teach a range of subjects to students aged 12 to 17 years. An important feature of this project is that the lessons delivered using Electronic Classroom are not undertaken in addition to pre-packaged distance education courses but directly parallel the program being taught in traditional face-to-face classes. Teachers taking Telelearning lessons use their own classroom materials, which are only modified, where necessary, for electronic transmission. In metropolitian Brisbane, the captial of Queensland, links between secondary schools as little as 6 kilometres apart have allowed for expanded student subject choice.

In Tasmania students studying Japanese at Murray High School students link with a teacher at the Tasmanian School of Distance Education. In Northern NSW a group of Central schools clustered around Moree use Electronic Classroom as part of a program to extend student subject choice in senior years (17 and 18 year olds).

Technical Colleges and Universities

In Victorian and Western Australia, Technical and Further Education Colleges already provide return-to-study and adult literacy programs and are trialing the teaching of accredited subjects.

At Southern Cross University sections of undergraduate degree courses are delivered from the Lismore campus to students at Open Learning Access Centres in Tweed Heads, Grafton and Port Macquarie. Postgraduate students enrolled in training and development courses have been involved in trial interstate links to share information on the last developments in industry responses to Commonwealth Government initiatives such as the Training Guarantee Act. The University has also trialled the teaching of short courses to industry and community groups. One such course involved motor vehicle repair firms and brought together a number of owner operators for training in accounting and costing techniques.

At Deakin University in Victoria the Faculty of Primary Teacher Education has linked preservice primary teacher education students on their Burwood campus with children in classrooms in the Castelmaine area. In the pilot program student teachers prepared and delivered weekly Electronic Classroom lessons on Indonesian language. During later teaching practicums the students lived in Castlemaine and taught the same children in the traditional classroom setting. Several other teacher training institutions are now considering training in audiographic technologies as part of their preservice programs.

Subjects taught

Across these various education sectors the subjects already taught using Electronic Classroom include: Accounting, Adult Literacy, Agriculture, Australian Studies, Botany, Chemistry, Chinese Computer Science, Economics, English, French, Geography, German, Graphic Communication, History, Human Development and Society, Indonesian, Information Technology, Italian, Japanese, Legal Studies, Mathematics, Music, Physical Education, Physics, Politics, Photography, Psychology, Secretarial Studies, Shorthand, Small Business Management, Technology Studies, Training Methods.....and this list is growing.

Evaluation studies

Gray and Grady (1993) report on the use of Electronic Classroom in twenty three high schools in the Queensland (Australia) education system. The authors undertook audiographics hookups with two schools and administered standard questions at the end of each semester. They found that a particular issue was the interrelationship of the development, largely by teachers in the field, to the bureaucratic structure of school administration. There was clearly an underestimation of the level of commitment to the program required by individual teachers and by administrative systems. They found that the methods used to train teachers in the use of the technology and the "theory" of distance education, by bringing in teachers for a week long course, was inappropriate. Training sessions should have been centred at the schools and been "hands on" from the outset.

The study found that students felt involved in the learning process more than might be the case with "regular" classroom methods, and that their capacity for self-learning and to express themselves was improved by the use of audiographics. At the same time, the "classroom" analogue and the scheduled class "meeting" ensured that the students did not require too great a leap from the reality of day to day school life.

Debreceny and Ellis (1994) report in detail on two case studies at the secondary and tertiary levels in programs administered in New South Wales, Australia. At the secondary level, the authors report on the Northern Border Senior Access (NBSA) program which is an initiative of the schools of the Northern Border region of the North-West of the state. It joins together the "central" schools of four remote townships to introduce a senior high school and are taught as a combined school and use a combination of local instruction, telematics and audiographics. The program particularly caters for students who for family financial reasons would otherwise be unable to undertake secondary studies as a boarder in a regional high school.

At the tertiary level Southern Cross University operates three Open Learning Access Centres (OLACs) in rural towns in Northern NSW. Units in the Bachelor of Business degree are offered in a variety of modes including the provision of traditional distance materials supplemented by OLAC visits and teletutorials through to units taught in "internal" mode via Electronic Classroom with the same materials, class exercises and assessment requirements as the "on-campus" students. Students found that the regular weekly contact via audiographics was preferable to the use of traditional distance materials. As adult learners they were clearly less comfortable in the use of the technology than their counterparts in the secondary system.

The findings of the case study, which was undertaken with a particular focus on the student, confirm many of the findings of Gray and O'Grady. Students were keenly aware that if it were not for audiographics, their access to Years 11 and 12 could be denied. They were able to clearly differentiate between the teaching styles of the different teachers in the programme. They had a marked preference for those teachers who did just not talk whilst a screen was on display on the computer but drew the students into the discussion. They found, however, that the teachers were clearly better prepared for their audiographics periods than they were for the regular classroom sessions.

The students made a number of complaints on aspects of the technology in use. They were particularly frustrated at the time it took to hook the different schools up at the start of the lessson. It could take as long as 10 to 15 minutes to get hooked up and transfer all the screens at the start of the class. This was seen as being wasted time and restricted the amount of time that was then available for the class session. There were also problems with modem lines dropping during the class in perhaps one class in four and the time it took to transfer screens of information.

In general students were happy with the use of the technology. Some students thought that Electronic Classroom was very worthwhile with one student saying that audiographics was the "whole foundation for Year 11 and 12". Other students found that ".. audiographics is just, you know, school. School is school.".

Acknowledgments
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